InkPhysics

ANSWER BOOK

Conservation of energy

Mechanics · Year 12

AQA 3.4.1.8 · CIE 5.1, 5.2 · OCR A 3.3.1, 3.3.2

10 questions · 31 marks

NAVY EDITION

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SECTION A · Warm-up

A1 Energy cannot be created or destroyed, only transferred from one form to another; the total energy of a closed system stays constant. [2]

A2 Gravitational potential energy is transferred to kinetic energy as the ball speeds up on the way down. [2]

A3 $KE = \frac{1}{2}mv^2 = \frac{1}{2} \times 4.0 \times 5.0^2 = 50$ J. [2]

SECTION B · Standard

B1 $mgh = \frac{1}{2}mv^2$, so $v = \sqrt{(2gh)} = \sqrt{(2 \times 9.81 \times 1.8)} = 5.94$ m s^{-1}. [3]

B2 (a) GPE = $mgh = 0.20 \times 9.81 \times 2.5 = 4.905$ J. (b) All of this becomes kinetic energy: $v = \sqrt{(2gh)} = 7.00$ m s^{-1}. [4]

B3 $\frac{1}{2}mv^2 = mgh$, so $h = v^2/2g = 6.0^2/(2 \times 9.81) = 1.83$ m. [3]

B4 Height drop = $4.0 \sin 30° = 2.0$ m. GPE released = $mgh = 5.0 \times 9.81 \times 2.0 = 98.1$ J. Work against friction = $10 \times 4.0 = 40$ J. KE at bottom = $98.1 - 40 = 58.1$ J, so $v = \sqrt{(2 \times KE/m)} = 4.82$ m s^{-1}. [4]

SECTION C · Stretch

C1 Height fallen = $25 - 10 = 15$ m. $\frac{1}{2}mv^2 = mg\Delta h$, so $v = \sqrt{(2g \times 15)} = 17.16$ m s^{-1}. [4]

C2 (a) Energy $\propto$ height, so fraction retained = $1.5/2.0 = 0.75$ (75%). (b) $v = \sqrt{(2g \times 1.5)} = 5.42$ m s^{-1}. [2]

C3 The total energy is conserved, but useful energy is progressively transferred to dissipated forms such as heat and sound that are spread out and hard to recover. 'Wasted' energy means energy transferred to a less useful form, not energy lost. [3]